If, however, instead of water they are kept over alcohol diluted with an equal volume of water, they may remain wet for weeks, without any such growth of mould or such alteration in the gum as is produced by the action of stronger alcohol. It is very desirable not to finally dry too quickly, but, as it were, to anneal the specimens; since contraction may give rise to sufficient tension to cause them to crack and scale off from the glass.

I must now consider cases in which it is desirable to get rid of part of the colouring-matter, either natural or developed on keeping. Diluted sulphurous acid is very useful for this purpose, and remarkable results can be obtained with small fishes. If plaice about 2¼ inches long are kept in alcohol and then for a few weeks in diluted sulphurous acid, the earthy matter of the bones is dissolved out and only cartilage left; the general colour is reduced, and the thickness diminished; but strange to say, the arteries and enclosed blood are so little altered that when the specimens are mounted the aorta and branching arteries are well seen over the whole animal, as shown in Fig. 4, which, however, fails to show the more minute arteries, quite visible in the original.

Having duly prepared the dried animals, it may not be convenient to mount them at once in Canada balsam, especially when living on a yacht. They may then be kept in tin boxes with flannel which has been well dried at a fire, so as to absorb any moisture that may be in the air. When thus kept, even for many months, they usually do not undergo any sensible changes and do not go mouldy.

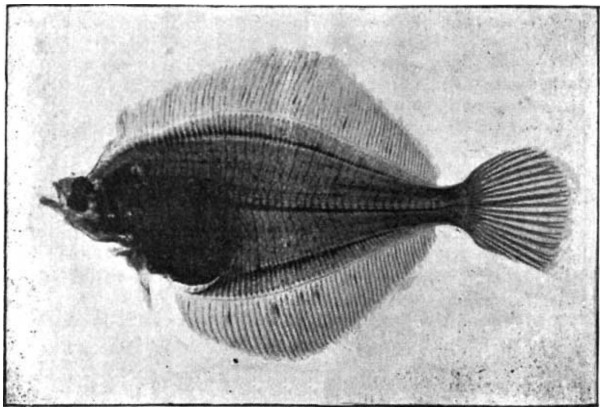

FIG. 4.—Plaice treated with sulphurous acid.

I must now conclude by describing the methods employed when finally mounting the specimens in Canada balsam. At the four corners of the glass should be gummed small pieces of blackened cardboard, of such a thickness that the cover-glass will just clear the object and not rock. The glass with the animal should be kept for a short or longer time in benzole; and, in the meanwhile, the cover-glass should be warmed on a suitable stand over a small burner, and a fair quantity of liquid balsam placed in the centre. The glass with the animal is then taken out of the benzole, and carefully placed over the balsam, so as to catch up as few bubbles as possible, the benzole causing the greater part to burst and disappear. If too little balsam has been used, more is easily run in between the glasses; and if only a few bubbles have been caught up, they soon disappear. If there are more than desirable, they can be got rid of by keeping the slide slightly inclined until they rise to one edge and can be removed. After keeping cold for a few days, for the balsam to harden the edges, it should be bound round with thin paper of the best quality, made thoroughly wet with gum. When this dries, contraction may squeeze out some superfluous balsam. This paper should then be varnished, and finally strips of good black paper should be *glued* well round the whole. All possible care should be used to enclose the balsam thoroughly, so as to avoid its turning yellow, and to prevent leakage, when the slide becomes warm in the lantern.

I have, however, had scarcely any trouble from this cause, since I have so completely fastened it in that the glasses or binding yield sufficiently. I may also say that though many of my slides have now been made for more than seven years, I have not observed any deterioration, but, on the contrary, many have greatly improved owing to the balsam having more completely penetrated into the tissues, and the included air disappeared. When this has taken place, the specimens are far more transparent and show their structure far better than the living or dead animals. Nearly all my slides have been kept in the dark, but some have been kept about the same time in a strong light at the Sheffield Public Museum, Weston Park, and, as far as can be judged, have not faded, even when imperfectly mounted. H. C. SORBY.

OUR MINERAL WEALTH.

IT would be difficult to conceive of a more concise and clearly expounded compilation of statistics and general information regarding mines and mining than that presented in the Third Annual Report upon the Mineral Industry of the United Kingdom of Great Britain and Ireland, which has been issued by the Home Office in the form of a Blue Book for the year 1896. The volume before us is a synoptical review of the condition of our own mineral industry, as well as that of other countries, which reflects unbounded credit upon its author, Dr. Le Neve Foster, and those who have assisted him in the work. It is divided into six parts, under the respective titles of persons employed, output, accidents, prosecutions, general remarks, and mineral statistics of the Colonies and foreign countries. It contains, in addition, nineteen appendices, and concludes with an exhaustive index.

The statistics for the United Kingdom distinguish between mines or underground workings and quarries or open workings; and the same figures are marshalled again and again under different aspects, so as to show their varying significance when coalfield is compared with coalfield, inspection district with inspection district, and county with county.

The first four parts include sixty-nine tables, in which the various classes of information susceptible of being so dealt with are compared with each other and with the corresponding figures for the year 1895. These are followed by six diagrams, on which are shown by means of curves, extending from 1851 to 1896 inclusive, the yearly variations in the numbers of persons employed above and below ground; the output and export of coal; output, export, and import of iron ore; deaths due to accidents generally; deaths from accidents, arranged in five distinct classes (explosions, falls of ground, in shafts, miscellaneous, and on surface); and the average quinquennial death-rate per 1000 persons employed, classified in the same way as in the last case. In Part iii. short descriptions are given of the circumstances under which the most important accidents of the year occurred; and throughout the volume many pertinent remarks are made, which serve to throw light upon the construction and meaning of the tables, point to the conclusions which they justify, and infer the lessons that are to be learnt from their perusal.

Turning now to a consideration of the subject-matter, we find that, taken altogether, there were 725,803 persons employed in or about mines during the year under review—576,325 working in the mines, and 194,478, including 5114 females, working on the surface. Of these numbers 678,690 were employed at 3260 coal mines, 16,819 at 136 iron mines, and 30,294 at 720 other mines. In addition to this there were 112,829 persons employed at 7758 quarries.

The quantity and value of the principal classes of minerals mined and quarried were as follows:—

Name of mineral.	Quantity.	Value at the mines or quarries.
	Tons.	£
Clays	11,341,782	1,442,069
Coal	195.361,260	57,190,147
Iron ore	13,700,764	3,150,424
Limestone ...	11,011,350	1,215,604
Sandstone ...	4,507,745	1,417,985
Slates and slabs ...	586,933	1,338,256

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The total value of all the minerals worked in the kingdom was 69,088,366*l.*, from which it will be seen that the value of the coal alone was practically five-sixths of the whole amount.

The number of separate accidents in mines was 886, involving the loss of 1065 lives, of which 147 were the victims of four explosions of fire-damp or coal-dust. The number of separate accidents in quarries was 117, in which 124 lives were lost.

A comparative table showing the death-rates from mining and quarrying accidents in different countries per 1000 persons employed, brings out some remarkable facts. Taking the column which represents the total for underground and surface for the year 1896, or in the absence of the figures for 1896 those of 1895, we find the following rates for the coal mines in some of the principal coal-producing countries of the world:—

Belgium	1·14
France (1895)	1·19
German Empire	2·57
Russia (1894)	1·29
United Kingdom	1·48
United States (1895):—	
Colorado	3·75
Illinois	1·94
Indiana	2·70
Indian Territory	1·64
Kentucky	1·02
Missouri	2·07
New Mexico	16·88
Ohio	2·11
Pennsylvania:—	
Anthracite	2·924
Bituminous	1·825
Utah	1·50

According to M. Louis Lacombe, who compared the death-rates from accidents in mines in quinquennial periods, the last of which was 1890 to 1895, the ratios are as follows:—

Russia 2·90, Belgium 2·38, England 2·18, France 1·37.

The death-rate from accidents to railway servants in the United Kingdom for the year 1896 is given as 1·01 per 1000. The category includes such classes as carmen 0·47, clerks 0·17, mechanics 0·33, and signalmen 0·55, whose occupations are not by any means dangerous. On the other hand, the death-rate amongst those who have to do with coupling and uncoupling and making up the trains is infinitely more serious, such as shunters 4·94, yardsmen, 3·27, guards and brakesmen of goods trains 3·03. The highest of these figures pales before those applicable to sailing ships, amongst which we find:—

British sailing ships (1896)	12·9
German ,, ,, (1893)	15·8

These figures prove conclusively that the miner's calling, when brought into comparison with some other kinds of employment, is not of such a dangerous nature as is generally supposed. As having a bearing upon this question, however, it may be stated that one of the most gratifying features of the report is the curve given on Plate 4, which shows the death-rate per 1000 persons employed underground in coal-mines to have been reduced from the appalling figure of 5·5 in 1851 to 1·62 in 1896. This result—upon the attainment of which the Home Office, the Inspectors of Mines, and the mining community generally may well be congratulated—is undoubtedly due to the efforts that have been made by means of legislation and inspection to remove the causes which formerly led to such a lamentable loss of life. The loss of 147 lives in four great explosions in the year 1896 is a black spot in the record which ought never to have been there. I am glad to observe that the year 1897 has been entirely free from anything of the same kind, and I feel confident that if the new regulations regarding the watering of dusty places, and the use of explosives are attended to, or enforced with unflinching severity, we shall have seen the very last of such affronts to humanity and common sense.

The fines imposed upon owners and managers of mines for contraventions of the Mines Acts amounted to the insignificant sum of 258*l.* 13*s.* 9*d.*, while the workmen for similar offences paid 459*l.* 6*s.* 8*d.*

The outputs of coal from a few of the principal coal-producing countries were as follows:—

		Metric tons.
1895	Austria, brown coal	18,389,147
	,, coal	9,722,679
1896	Belgium	21,252,370
1895	France, brown coal	437,000
	,, coal	26,109,893
1896	German Empire, brown coal	26,797,880
	,, ,, coal	85,639,861
1896	Great Britain	198,496,339
1895	Russia, anthracite	709,718
	,, coal	8,369,420
1895	United States, anthracite	52,616,149
	,, ,, coal	122,577,246

From these figures, with which I propose to bring this short and necessarily fragmentary notice to a close, it will be seen that this country still heads the list; but the United States are quickly overtaking us, and will, no doubt, come into the first position in the course of the next few years.

W. GALLOWAY.

CALCIUM CARBIDE AND ACETYLENE.

AT the meeting of Institution of Civil Engineers on March 15, a paper on "Calcium Carbide and Acetylene" was read by Mr. Henry Fowler, and is here abstracted.

Acetylene was first isolated by E. Davy in 1837 from potassium carbide, a by-product of Sir H. Davy's method of manufacturing potassium. In the middle of the century Berthelot investigated its properties, and Wöhler produced it from calcium carbide. During the past few years it has assumed commercial importance owing to the development of the electric furnace, in which calcium carbide can be readily produced from lime and carbon. The furnaces used consist essentially of crucibles with carbon rods forming the positive electrode and a bottom plate lined with carbon for the negative. In the more recent furnaces these crucibles are mounted on small trollies so that they may be run out of the furnace when ready and a fresh one inserted without loss of time. The carbide formed is a hard, dense substance of reddish colour, unacted upon by most of the ordinary reagents. It is, however, rapidly decomposed by water into acetylene and lime, giving 5·9 cubic feet of acetylene, at a temperature of 60° F. and a pressure of 30 inches of mercury, per 1 lb. of carbide. As the power required theoretically to produce 1 lb. of calcium carbide in an electric furnace is more than 2 H.P. hours, its manufacture is at present restricted to localities where power is cheap, as for instance where water-power is available.

Acetylene is a colourless gas with an intensely penetrating odour, and is slightly soluble in water, and extremely so in some other fluids. It is endothermic, giving 407 calories per cubic foot, whereas theoretically its value is 336·5 calories. As an illuminant it gives the most brilliant light of all gases, 5 cubic feet per hour under suitable conditions giving 240 candle-power. For small consumptions, however, this value is not obtained, and ordinary burners after a short time became clogged with soot. The latter defect can be overcome by the use of an injector burner, which, however, requires a higher pressure. Various diluents have been suggested, but have not been tried on a practical scale. The flame has a high actinic value, and causes light colours to appear lighter, and dark colours darker than when exposed to sunlight. The gas, when inhaled, combines with the hæmoglobin and renders the blood incapable of taking up oxygen, and thus causing suffocation. It has, however, been shown that it is no more dangerous in this respect than coal gas.

Acetylene unites with copper, in the presence of moisture and ammonia, forming copper acetylide, and this when in a dry state is violently explosive. Silver is similarly acted upon.

Owing to the difficulty of obtaining the materials used in producing calcium carbide in a pure state, phosphoretted and sulphuretted hydrogen and ammonia are often found in the gas, and these should be removed by passing the gas through water and an acidified solution of a metallic salt. Nearly all proportions of air and acetylene are explosive, the gas itself being decomposed at 780° C. At higher pressures than 2 atmospheres, if this temperature is attained by a part of the gas, it is communicated throughout the whole mass and a violent explosion occurs, which causes the pressure to rise to eleven times the initial pressure; but owing to cooling by radiation, &c., this is not reached in practice. Acetylene can be readily liquefied, having a critical temperature of 37° C. and pressure of 68

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